THE GLASS INDUSTRY

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HIGHLIGHTS OF THE GLASS DIVISION MEETING

The Glass Division of the American Ceramic Society held its annual summer meeting at Hershey, Pa., September 6 and 7. There were two half-day sessions of technical papers, an afternoon of golf and sports, and a formal banquet—the latter curtailed somewhat to allow members to attend an exhibition game of professional football. Approximately 100 attended. The golf tournament was won by J. K. Martin, Jr. of Lancaster Iron Works, while a special prize to the winner of the best 18 holes went to S. R. Scholes of Alfred University. The beautiful location of Hershey and its very attractive Hotel, one of the show places of the East, contributed to the enjoyment of the meeting. A special program for the ladies, in which non-golfing males participated, was a visit to the Hershey chocolate factory and to the Hershey Industrial School.

The papers and discussions were devoted primarily to the subject of inhomogeneity, with particular reference to the ubiquitous cord. Two methods of approach to the identification of cords, one synthetic and the other analytical, arrived at two different conclusions. One of these supported the preconceived notion that most cords are aluminous in character; the other arrived at the rather startling conclusion that cords, at least in bottle glass, are silicious.

Dr. Silverman, of Owens-Illinois, attempted to correlate the surface tension of glasses with cord-forming tendencies. He reported that when fibers of composition different from that of a glass slab are laid upon the slab and slowly incorporated into it by prolonged heating, the outlines of the fiber disappear at a more rapid rate when the glass of the fiber has a lower surface tension than that of the parent glass, or the glass of the slab. This was demonstrated by an interesting series of photomicrographs presented as slides which showed the gradual disappearance of the fiber. Doubt arose in some minds as to whether this disappearance signified the incorporation of the fiber in the parent glass, or simply its spreading in a complete layer over the surface. At any rate, it could be shown that when the fibers were high in alumina, which causes a rise in surface tension, their disappearance was very much slower, and the conclusion was drawn that some cords very likely represented segregations of aluminous material. In view of the fact that others have previously analyzed cordy glass and found high alumina content, and the further fact that cords commonly follow rapid corrosion of tank blocks, this conclusion seems not improbable, whatever may be the short-comings of the experimental demonstration.

The case for the silicious cord was presented by Dr. Preston, who reported on the highly original method of physical separation worked out by Dr. Turnbull of the Preston Laboratories, with the collaboration of Dr. Ghering, who analyzed the separated materials. Dr. Turnbull crushed cordy glass to a fine powder, accurately sorted as to grain size, heated the powder to eliminate hydroscopic moisture, and subjected it to the buoyant effect of immersion in a heavy liquid whose specific gravity was controlled by variations in temperature by thermostatic means. At the same time, gravity was augmented by centrifuging the tubes containing the liquid and powdered glass up to about 1,000 g. By using constricted tubes for containers and by freezing the suspensions, the investigator was able to separate the portions which floated from those which sank. Identification of the particles representing cords became possible through a control experiment in which cord-free glass was treated. It was concluded that the cords represented glass which floated away from the parent glass, that is, whose specific gravity was lower. Analytical results showed that the cordy glass contained more silica than the parent glass.

Specific gravities by this process could be expressed in terms of the temperature of the immersion liquid. Because of the close control made possible by the thermostat, a rather high degree of accuracy was claimed for the experiments. When homogeneous optical glass was treated in this manner, the margin between floating and sinking was a matter of a small fraction of a degree of temperature and this was cited as a measure of the accuracy involved.

This highly original and interesting attack on the problem, leading, as it did, to unexpected results, not only out of line with current beliefs, but also quite opposite to the results of the fiber-and-slab experiments, aroused one of the most earnest discussions ever provoked by Glass Division papers. The respective experimenters met the attacks very well, and the result was that the members were left somewhat puzzled and definitely undecided. However, both papers are to be commended because each one offers a new and hopeful approach to the solution of an ever-present problem of great importance in the production of glass.

Chairman Lester of Maryland Glass Corporation announced some interesting findings in connection with the flakes that occasionally appear in bottles used to contain beverages of favorable pH. It seems that if the

THE GLASS DIVISION SUMMER MEETING

As scened by the cameras of glassmen E. L. Hettinger, J. R. Hostetter, Victor J. Remington and Ernest Hommel

Terrace entrance to the Hotel Hershey, with S. R. Scholes and Donald Sharp discussing Friday's Session with their colleagues.

Glassmen standing-by waiting for the morning session to get under way.

Dining room scene. Though only 9 a.m., most of the glassmen already have breakfasted. Bosses please note.

Frank Preston lecturing on upward drilling. A rare shot of the least photographed member of the Glass Division.

The glass division banquet, with everyone trying to make the referee's 8:30 whistle which started the football game.

Afternoon session, with the technologists intent on the program.

K. B. McAlpine intent upon a demonstration of upward drilling.

Dr. J. C. Hostetter and J. C. Turnbull of Preston Laboratories in conversation at the entrance to the meeting room.

J. K. Martin, Lancaster Ir... tells George J. Bair of Mello... how he won the golf to...

(Left) Dr. G. E. F. Lundell conducting his round table discussion on Chemical Analysis. (Below) L. C. Roche of Marylalnd Glass watches Mrs. Roche and Vic Remington take each others pictures.

manuel of Armstrong Cork discussing ng" with A. Herman of Seagram's.

W. R. Lester, chairman of the Glass Division, takes a time out for a chat with C. B. Kingsley, Mississippi Glass.

"Chats" and Mrs. Walsh, and do we need to add: Beloved by everyone.

Williams and W. F. Curtis of Fostoria h W. C. Taylor of Corning.

Donald Smith, Kimball Glass, and Lewis Austin of Gaynor on a balcony of the Hotel Hershey.

Fred Schroeder of A. P. Green talks refractories with Virgil Mulholland.

Mayhew, J. Henry, Fred Pinotti, and ene of the Kimble delegation.

Pipe vs. Cigarette. Nelson Wendt of American Potash and N.S.C. (Chats) Walsh of Walsh Refractories.

R. J. Houze II and Ernest Hommel, the latter the gifted photographer who took many of these pictures.

k Bacon Owens-Illinois esses the meeting.

Sonja Heinie, famous skater, kindly gave her autograph to many.

Francis Flint lights a pipe, while Mrs. Roche lends encouragement.

Newsman J. R. Hostetter and V. H. Remington of Drakenfeld.

glass contains magnesia these flakes may appear, whereas, the same treatment will not bring out flakes from glass made with calcitic lime. Also, it is possible to generate flakes from a calcite glass by digestion with magnesium hydroxide. The investigator explains the phenomenon by assuming that magnesium silicate, being highly insoluble, is precipitated on the inner bottle surface and later dislodges in the form of the objectionable suspended flakes. The argumentative mood of the gathering was again demonstrated when others, experienced in the durability testing of bottles, maintained that flakes had been noted in bottles whose glass contained no magnesia. Such differences of opinion make technical sessions, as well as horse races, interesting; but it appears that a rather neat array of facts are on the side of Mr. Lester's theory of the magnesia responsibility.

The paper by Lyle and Sharp of Hartford-Empire Company, read by Mr. Lyle, had more information as to the type of accelerated test which may be held to correspond reasonably with service tests on the durability of glass. Before long, these investigators will be able to specify with some precision, once they get a bottle into hot water, how long it needs to stay there to get a lifetime of experience.

On Saturday morning, Preston and Turnbull gave an interesting demonstration concerning the familiar phenomenon of the upward drilling or honeycombing of tank blocks by glass. The members were shown how cubes of ice, floating in a solution of methyl alcohol and water, had cavities drilled into their lower surfaces by tiny bubbles forming from the liquid. This boring effect of gas bubbles on solid material was surprisingly interesting; and the experiment augurs well for a better understanding of this destructive phenomenon. That powerful, and little understood agent, surface tension, seems about to become as popular as a means of explaining the inexplicable in our business as catalysis has been for many years among chemists.

Our one-man-faculty of analytical chemistry, Dr. Lundell of the Bureau of Standards, conducted another seminar for glass analysts. We feel sure that his missionary efforts are resulting in better work and in a better understanding of the difficulties and limitations of this important duty of glass technologists.

The report of Committee C-14 A.S.T.M. was read by the secretary in the absence of Dr. Navias. Nothing startling was disclosed, but it was indicated that steady and consistent work is going on in the study of glass as an engineering material.

The Effect of Surface Tension on the Formation of Cords. *By W. B. Silverman, Owens-Illinois Glass Co.*

The seriousness of cordy conditions in commercial glasses is such that it is highly desirable to have data concerning the physicial conditions that control cord formation. As viscosity and surface tension are the two physical properties of glass that are usually associated with cord formation, their influence has been studied by the synthetic formation of cords in a base glass. The chemical composition, viscosity, and surface tension data of both the base glass and the glasses used to form the cords were known.

The procedure used for synthesizing the cords consisted of placing a homogeneous glass blank in a platinum boat, heating to 800°C, placing a glass fibre on the hot surface of the blank and reheating both the blank and the fibre to 1240°C, holding at this temperature for 10 minute, 2 hour, and 5 hour periods. After these treatments, the boat is taken from the furnace and the glass blank annealed. The blank is then examined in polarized light for evidences of cord formation. Fifteen different glass compositions were used for the cord forming fibre, the differences between the surface tension of the base glass and the cord forming glass fibres being as high as +23 dynes and as low as —15 dynes. The ratio of viscosity of glass to base at 1250°C varied from 0.17 to 233.0.

From the results obtained, it was concluded that the role of viscosity in the formation of cord is of minor importance and that surface tension differences are more important. In general it was found that if the surface tension of the inclusion is greater than that of the matrix, no cord will be formed. As alumina, calcia, and magnesia have the effect of raising the surface tension of a glass, cords should have higher alumina and RO contents than the matrix in which they are found.

The Homogeneity and Heterogeneity of Commercial Glass. *By F. W. Preston and J. C. Turnbull, Preston Laboratories.*

After a short discussion on the importance of knowing the cause of cordy conditions in glass and the various methods that have been used in the study of cord, a new method which has been recently developed by the authors was presented.

In brief this method consists of selecting a cordy area of glass, crushing and grinding the sample and screening so as to obtain particles of about 300 mesh size. A suspending liquid is then prepared by mixing iso propyl salicylate (density, 0.9) and S-tetrabromethane (density, 3.0) in such proportions that the density of the liquid just matches the density of a small lump of the glass sample.

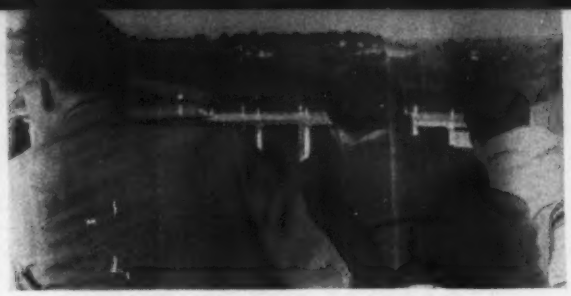
Traces of water are then removed from the suspending liquid mixture by refluxing under vacuum and from the glass powder by heating in a vacuum furnace at 525°C. This latter operation also serves to anneal the glass powder. The dried powder and liquid are then transferred to a small glass centrifuge tube which is then sealed. The glass powder and liquid is centrifuged in a water-cooled centrifuge, the temperature of which may be changed, thus changing the density of the suspending liquid. By this means the light and heavy portions of the glass sample may be separated and collected.

About 0.2 grams each of the various fractions are collected and used for the chemical analysis. Standardized procedures such as the triple acetate method for sodium and the 8-hydroxyquinoline method for alumina and magnesia are used in the method of analysis. Silica is usually determined by difference.

Many examples of cord in glass have been separated by this method and the chemical analysis of the cord fractions obtained from container glasses, for example, have shown that the cord is usually low in soda, calcia and magnesia, normal in alumina content, and from 1 to 2 per cent high in silica content when compared with the percentage composition of the matrix glass. All of the cords, so far studied, seem to be due to batch weighing errors, batch segregation or stagnant glass. As yet there has been no evidence of high-alumina cords as would result from refractory solution.

In the polariscopic or microscopic examination of cord the degree of cordiness is usually expressed by the use of an A, B, C, D, etc. method of grading. For obvious reasons such a system cannot be placed on a strict quantitative basis. By the use of the density separation method the degree of cordiness may be measured in a quantitative manner much more successfully than has before been possible. As the density of the liquid changes with change of temperature (1°C change in temperature equals 0.0018 change in density) the temperatures at which the heaviest and the lightest fractions of glass powder just float will give the density range of the heterogeneous powder. This temperature difference when multipulied by the density change per 1°C will give the density difference and thus is a quantitative measure of the heterogeneity of the glass. It was shown that glass of optical quality had a negligible density difference, while container glass of the so-called B grade of cordiness showed density differences of about 3°C (0.005 density difference), while the C minus grade glass gave much higher density differences.

E. O. Hiller of Hartford watches John Ogden address the ball.



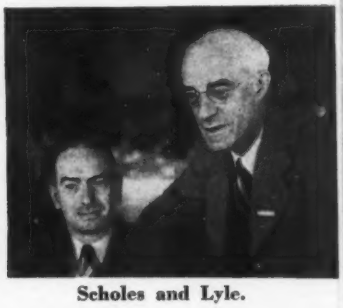
Van R. Ostrander, D. Smith, and L. Austin.

A. K. Lyle of Hartford giving his paper on Chemical Durability.

C. J. Copeland (left) and E. O. Hiller, finishing their swings.

Ross Purdy and solons in the cocktail lounge.

Discussion Group.



Scholes and Lyle.

Phillip (himself) Morris brings refreshments.

Mrs. E. W. Paxton and escorts.

Mrs. W. R. Lester, Delgado, Wash and Wendt.

gado of The Glass Industry chats Martin of Lancaster Iron Works.

Mesdames Sharp, Flint, Lyle, Roche and Wheaton before starting on their visit to the chocolate factory.

Adams, Lundell and Flint. Pittsburgh looks on while Washington, D. C., banters with Washington, Pa.

The Flaking of Glass Containers. *By W. R. Lester, Maryland Glass Corp.*

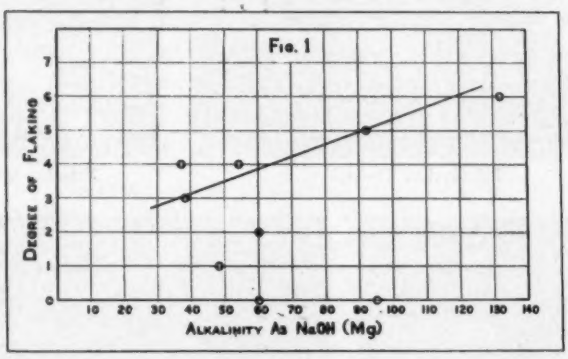
One result of the attack of water or alkaline liquids on glass is the formation of insoluble products. These insoluble products are known and described as spicules or flakes. In this investigation an attempt was made to tie in the flaking tendency of a glass with its chemical composition.

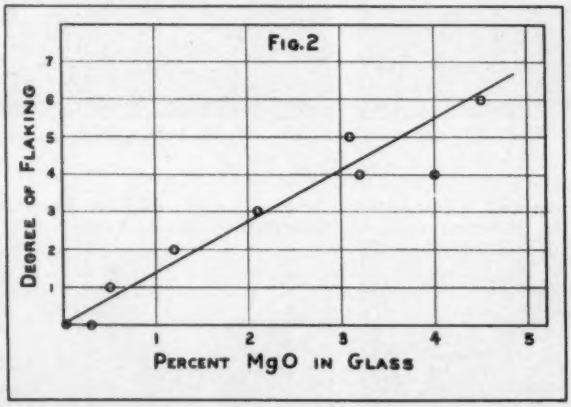
A series of nine commercial 4 oz. capacity bottles of various chemical compositions were tested by several different chemical durability methods and both the degree of flaking and the alkalinity values determined. No satisfactory relationship was found to exist between the alkalinity value and the degree of flaking. When the degree of flaking was compared with the magnesia content of the glasses it was found that the formation of flakes depended upon the amount of magnesia present in the glass. Glasses containing little or no magnesia did not form flakes in the test method used, while glasses containing varying amounts of magnesia formed flakes in amounts roughly proportional to the magnesia content. These relationships are shown graphically in Fig. I and II. The glasses in which calcia was the predominate constituent of the RO group, and which did not flake, all showed flake formation when small amounts of magnesium containing compounds were added to the distilled water used as the attacking medium.

The compositions of the flakes produced by the attack of water and sodium hydroxide solutions on dolomite glasses and by the attack of magnesium hydroxide solutions on calcite glasses were determined by chemical analysis. In all cases the flakes were found to contain silica, R_2O_3, calcia and magnesia, the latter constituent predominating except when sodium hydroxide was used as the attacking medium. In this case the calcia and magnesia were found to be in the dolomite ratio.

From the data obtained it was believed that the mechanism of flake formation could best be explained by assuming that the reaction between the glass and the attacking medium consisted first in the formation of sodium hydroxide, calcium hydroxide and magnesium hydroxide. The sodium hydroxide then reacts with the silica in the glass to form sodium silicate. A base exchange reaction then takes place between the $R(OH)_2$ group and the sodium silicate with the formation of soluble calcium silicate and insoluble magnesium silicate. When the solubility limit of calcium silicate is reached, increasing amounts of this material will be found in the flakes as the reaction between the glass and liquid proceeds.

Other data presented showed that flaking is a continuous process and that with repeated attacks by water, flakes would continue to form provided that the amount of attack was great enough. It was also shown that under certain conditions the insoluble products formed are deposited on the glass surface in the form of a thin transparent film and may thus escape observation. Such insoluble films could be detected by reflected iridescent colors from the film surface.





Report of Committee C-14, A.S.T.M. Activities. *By L. Navias, General Electric Co.*

In the absence of Dr. Navias, this report was read by Dr. S. R. Scholes, who first mentioned that the report was in the nature of a progress report presented to the Glass Division in order to keep the members informed of the activities, past and present, of the A.S.T.M. Committee C-14 on Glass and Glass Products." The summary of the report follows:

1—Officers for 1940-42

Chairman, G. W. Morey
Vice Chairman, U. E. Bowes
Secretary, L. Navias

Advisory Committee

J. C. Hostetter
G. F. Jenks
J. T. Littleton
R. W. Wampler
and the three officers

2—Nomenclature and Definitions

There has been some discussion on the definition of the word "glass." Some of the members believe that it should include only the inorganic glasses, while others believe that it should include the "true" organic glasses on the basis of their reversible thermal behaviour.

3—Chemical Analysis

This subcommittee intends to develop work along the lines of rapid routine procedures such as the triple acetate method for soda, 8-hydroxyquinoline methods for alumina and magnesia and the Hicks method for potash. It is hoped that standard methods of routine glass analysis will be the result of this work. Standard methods for the analysis of alumina silicates will also be developed when time permits.

4—Chemical Properties

The retiring chairman (D. E. Sharp) of this subcommittee has presented the committee with a voluminous report covering the work completed during the past three years. In general more attention is being paid to the development of surface tests using dilute acid or water. The correlation between accelerated tests and service conditions is also being studied.

5—Physical and Mechanical Properties

The methods for Polariscopic Examination, Pressure Testing, and Thermal Shock have been revised so as to include methods of sampling new and used bottles. A standard method of measuring the modulus of rupture of glass test pieces has also been adopted by the committee.

6—Glass Construction Block and Tile

The manufacturers of these products have been working on pertinent data regarding these materials and the data will be available for study in the near future. Light transmission and heat transmission studies on glass block panels are also being made.

A.S.T.M. Report on the Chemical Analysis of Glass. *By Dr. G. E. F. Lundell, National Bureau of Standards.*

A brief report was given regarding the Proposed A.S.T.M. Methods for the Chemical Analysis of Glass which have been drawn up in response to a request for such methods by Committee C-14 of the A.S.T.M. (*Continued on page* 453)

GLASS CONTAINER INDUSTRY TRIAL SET FOR OCTOBER 15

Pre-trial conference on October 1 ends in deadlock after Government refuses any settlement that does not provide for dissolution of Hartford Empire Co. and sweeping injunctions containing admissions of guilt of conspiracy on the part of all defendants.

Inability of the glass companies, Hartford-Empire and the Government to come to any meeting of the minds at their pre-trial conference October 1 makes it seem likely that a long and bitterly contested trial is inevitable. Government's insistence that Hartford be dissolved and that all defendants admit guilt of conspiracy has brought about a very rigid deadlock.

Federal Judge Frank LeBlond Kloeb refused requests for postponement of the trial beyond October 15, but has placed himself at the disposal of both sides. He is anxious to have the issues narrowed down as much as possible. However, the uncompromising attitude of the Government attorneys makes it seem probable that few concessions will be made by either side.

The October 1 conference was the sequel to a series of similar pre-trial meetings between the Government, the defendants and the Court, held for the purpose of defining the issues more precisely, and to establish, if possible, some basis for an out-of-court settlement. These conferences came to a head on September 20. On this last occasion, the public was given its first real insight to the situation.

At this September 20th conference, attorneys for Hartford, Corning, Owens, Hazel-Atlas, Ball, Thatcher, Liberty, Anchor-Hocking and Lynch announced that under certain conditions they were prepared to accept sweeping injunctions. While they denied any guilt, they stated that they would accept these injunctions and make concessions far beyond the requirements of the situation, if they could avoid the expense of a long and protracted trial. Judge Kloeb directed attorneys for both sides to confer upon the details of such a settlement and report to him October 1. The court named October 15 as the date for opening the trial upon any points that might then remain uncompromised.

Hartford Empire Company

Important objective of the Government's crusade was the Hartford licensing system. On this point, Hartford evidenced a complete willingness to go the whole way in giving the Government the relief it sought. Hartford gave conditional agreement to:

1. Abandonment of all restrictive licensing. Hereafter, all of its licensees would be permitted to make any type of ware, in any quantity, and for any purpose. Exclusives would be cancelled: from Thatcher, Owens, and Liberty, to manufacture milk bottles; from Ball, Hazel-Atlas and Owens, to manufacture fruit jars, from Corning, to manufacture heat-resistant ware and certain specialties.

2. Place no restrictions upon the number of feeders a licensee could acquire, but allow him as many as he felt were necessary to his business.

3. Grant licenses to any new company desiring to enter the field, upon evidence of adequate financial responsibility.

4. Abandon all tying-in clauses; such as those limiting Hartford and Lynch machines to use with Hartford feeders.

It is obvious to anyone familiar with the glass container industry, that should Hartford waive these features of its licensing contracts, any semblance of restrictive licensing would disappear. And Hartford stated it was willing to go that far. However, it flatly refused to accede to the Government's demand for dissolution of the Hartford-Empire Co.

This refusal induced Mr. Isseks, special assistant to the Attorney General, to remind the Court that the main purpose of the suit was to destroy the monopoly and he insisted this could not be effected without dissolution.[1]

This desire on the part of the Government to effect the dissolution of Hartford was set forth in its complaint under item 9, Relief Requested: "That the defendant Hartford-Empire Company be dissolved and that its patents and other properties be rearranged under several separate and independent corporations, independently owned . . .". This plan of dissolution Mr. Isseks developed further, stating that he felt Hartford should be broken up into four corporations, each owning an equal share of all the Hartford patents, each having its own and differing licensing systems, and each competing directly with the other three.

The Glass Companies

Hartford having expressed its willingness to abandon restrictive licensing, the other parties to these licensing contracts were due to be heard from. Some of them possessed exclusive or partly exclusive rights to certain fields of ware, a contractual relationship which Hartford could not legally dissolve except by mutual consent. This consent each glass company proceeded to give: Corning[2] to its exclusive on heat-resistant ware; Thatcher, Owens and Liberty to milk bottles; Ball, Hazel-Atlas and Owens to fruit jars, and so on.

Ball was willing to negotiate a settlement of the Knox and Brockway contracts; Thatcher, of those with Knox and Hamilton. I. J. Collins of Anchor-Hocking would dispose of his 5 per cent interest in Hartford. Ball clashed with the Government on the matter of its Three Rivers Plant—it was willing to sell the plant "if the Court could find a buyer at a satisfactory price;" Government insisted the plant must be sold on the auction block.

At the conclusion of this September 20th conference, it seemed as if the more important points at issue had reached an agreement, in principle at least, while practically all others would yield eventually to negotiation. Notable exceptions to the latter were:

[1]Mr. Isseks stated to THE GLASS INDUSTRY that the Government would accept only the following two alternatives with respect to Hartford-Empire: (1) Dissolution of the corporation; or (2) trial under Section 2 of the Sherman Act (relating to monopolies and attempts to monopolize), with proper and adequate injunctions resulting therefrom.

[2]Corning insisted on retaining three exclusive licenses: (1) a patent on the Danner Machine, (2) the Howard Auto-Blow Patent, and (3) the Smith Re-Issue Patent.

1. Empire Machine Co. (Corning controlled) was unwilling to divest itself of its 42 per cent interest in Hartford, stating this is unnecessary in view of the corrective measures promised by Hartford. Moreover, that to do so would entail tremendous tax costs.

2. Hazel-Atlas was unwilling to cancel its 1932 agreement with Hartford through which it participated in Hartford royalties. Hazel-Atlas defended this contract as being in effect a form of liquidated damages for rights it surrendered. Government insists the contract be cancelled and that any agreement replacing it be made fully known to the entire glass container industry.

Such were the highlights of the September 20th conference. At its conclusion, it appeared on the surface as if the case almost inevitably would be settled without a trial; in fact, newspapers throughout the country carried headlines to the effect that all was over but the shouting. The Government's prime objective—the breaking of the alleged monopoly—could be attained if the practices it complained of were permanently enjoined, and to this the accused had consented subject to the one condition that the injunction would contain no allegation of guilt of conspiracy. Observers believed this concession was a small price for the Government to pay in exchange for winning every major point in its suit, and their belief was strengthened by the fact that this anti-monopoly suit was a civil action only, with no penalties asked.

Why did the Government refuse any compromise? Perhaps it will throw some light upon the question to remember that this particular monopoly suit differs from all other monopoly suits in that it involves patents. Patents are themselves monopolies—monopolies existing by specific authority of Congress. To support its contention that monopoly resulting from the exercise of patent rights are violations of the anti-trust laws, the Government has no statutory authority. It appears to be seeking to write such an interpretation into the law by means of precedents—and to establish a precident one must have court trials. Of course, the Government's real intentions can only be surmised; but this surmise at least furnishes a logical explanation for its unwillingness to compromise.

It will be remembered that all the compromises offered by both the Hartford-Empire Company and the glass companies were conditional upon the defendants being saved the trial expense. Now that a trial appears inevitable, will the glass companies start again from scratch and fight every allegation of the complaint, or will there be some narrowing of the issues? Will Hartford recant its willingness to modify its licensing system? No definite answer on the first of these points will be forthcoming before October 15. On the second, Hartford attorneys have indicated that quite irrespective of what the Government does or does not do, Hartford plans to remove the restrictive clauses in its licensing system.

One final bit of local color. The judge in this case is Frank LeBlond Kloeb. Some reports have stated that Judge Kloeb was a carrying-in boy in a glass factory during his younger days; but this is not the case. Interviewed on this point by a representative of THE GLASS INDUSTRY, the Judge suggested that this report may have arisen from his having been born at Celina, Ohio. Celina, in those days, was a town of some 2500 souls, and its major industry was glass making. The period coincided with the discovery of great deposits of natural gas through Indiana and Ohio, and many glass companies became attracted to the locality for the cheap fuel supply it made available. Judge Kloeb still can recall the picture of the countryside lighted up at night by the flares from innumerable gas wells, to which the farmers had set fire for no apparent good reason than to enjoy the spectacle. Many Celina families moved across the Indiana line when Ball Bros. established themselves at Muncie.

OWENS ANNOUNCES "DURAGLAS"

A new technique in glass making, called Duraglas, resulting in a stronger and more durable container than was heretofore possible to produce, has been announced by the Owens-Illinois Glass Company.

"Duraglas," according to officials of the company, has been placed in production at several of the glass plants under its operation, and will be available in quantities for the beer and beverage market immediately.

Coincident with this development, it was revealed that fundamental changes have been made possible in bottle architecture in line with the demand for the ultimate in design in modern packaging. In addition, it was pointed out that the new architecture of the glass container likewise will contribute both to its durability and its serviceability.

The new technique embodies not one development in glass making, but a combination of many. Owens-Illinois Glass Co. states that its new te hnique includes:

"An exact determination of the fluidity of molten glass of various batch mixtures with resulting improvement in fabrication; improvements in batch mixing and automatic weighing assuring absolute uniformity; better laboratory controls governing quality of raw materials; simplification of glass furnaces and automatic feeding; modernized heat recording instruments, assuring accurate furnace control; and further developments of the Owens automatic vacuum bottle-making machine including synchronization of the melting pot to the machine."

Engineers also point to the fact that Owens-Illinois Glass Company now has perfected the synchro-flash finish, insuring accuracy of sealing surfaces and a smoother lip and has incorporated such important manufacturing improvements as automatic handling of bottles and other automatic devices which gauge finishes and body dimensions to a fine degree of accuracy.

CORNING'S RIGHT TO "PYREX" UPHELD

The United States Circuit Court of Appeals amended one of its recent decisions by removing a single sentence which implied that the word "Pyrex," a trademark of Corning Glass Works, had become public property. In amending its opinion the Court went further by adding a clarifying statement: "We are not holding that the word has ceased to exist or lost its validity as Corning's trademark."

The case which was thus settled by the Eigth Circuit Court of Appeals originated in a suit brought against Corning Glass Works by the Obear-Nester Glass Company in St. Louis, charging an infringement of their trademark "Rex." The Federal District Court, having ruled in favor of Obear-Nester, Corning carried the case to the Circuit Court of Appeals which unanimously reversed the decision of the District Court, ordered the case dismissed on its merits and denied the petition of Obear-Nester for a rehearing.

FINISHED WARE CONVEYING SYSTEM SUSTAINS PRODUCTION AT CARR-LOWREY

Ware handling needs, occasioned by installation of new production unit, have been met by a comprehensive conveying system from lehrs to warehouse and shipping department.

In the minds of many plant engineers and executives, particularly in the glass industry, the employment of materials-handling equipment is a matter for consideration only when comparatively few items or sizes are to be transported in considerable quantities. But these stipulations do not hold in the case of the finished ware conveying system installed and successfully operated by the Carr-Lowrey Glass Co., Baltimore. As a matter of fact, the Carr-Lowrey production incorporates an exceptionally large number of items, including pharmaceutical, proprietary, perfume, cologne and toilet bottles, cosmetic jars, etc. Some are high-production items; some are made in comparatively small quantities; some are made on automatic machines and some are still produced by hand. Packing containers include both paper cartons and wooden boxes, in a great variety of shapes and sizes. All in all, therefore, the usual reasons against the use of a ware conveying system seem to be present at Carr-Lowrey, yet the installation has proved efficient and economical from the start.

The building of a new plant addition at Carr-Lowrey, described in THE GLASS INDUSTRY, October, 1938, created two new transport problems because of its location on the river bank, some distance from the batch preparation plant and from the finished product warehouse. The batch transport was taken care of by batch cans carried in a special cart drawn by a tractor. Ware transport was for a time accomplished by hand trucks, but the present ingenious conveying system was the final answer to this part of the transportation problem. From the ends of the lehrs at the new No. 6 tank to the warehouse the distance is about 225 ft. and storage space in the warehouse is located on two floors. The conveyor from the other lehrs had to have a length of some 150 ft. to the warehouse. These facts, together with the necessity of being able to send some ware directly to the shipping department, indicate some of the difficulties that were overcome in reaching a satisfactory layout.

Before going to either warehouse or shipping department, all ware passes through a general distribution point located in an auxiliary building about 40 ft. from the north end of the warehouse. The equipment at the distribution station is shown in Fig. 1, and from here it is possible to orient oneself with the entire system. All ware from the lehrs approaches the station on the roller conveyor in the lower left corner, this being the end section of two conveyors, one of which extends nearly 250 ft. straightaway to No. 6 tank, the other going out about 125 ft. and then turning left for 60 ft. to reach the ends of the other production lehrs. The two conveyors leading off to the left from the main line in Fig. 1 serve the warehouse space, the first one carrying ware to the upper floor and the second one to the lower floor. If ware is not turned off to the warehouse at the distribution station, it passes over the roller section at the right. At a distance of about 30 ft. it may be switched to a roller section leading to the truck loading platform, or it may go on another 25 ft. to the conveyor branch for the railway platform.

The bottles coming from the lehrs at No. 6 tank are inspected and packed at stations, such as shown in Fig 2. The empty carton rests on a short, hinged, counterweighted section of roller conveyor and, when the carton is filled, the conveyor section is raised and the filled

Fig. 1. To this general distribution station near the warehouse of the Carr-Lowrey Glass Co., packaged ware comes from the production departments along the roller conveyor in the lower left corner. The two belts leading off to the left go to the second and first floors of the warehouse, respectively, and ware destined for the shipping department passes straight on toward the right.

Fig. 2. This is a typical inspection station at No. 6 tank. The empty carton rests on a counterweighted roller section. When filled the section is raised and the carton is pushed upon the cross conveyor in the background.

carton is pushed out on another section of gravity roller conveyor which leads across the ends of the lehrs to a gathering and counting station in the center. The cross conveyor can also be seen in the background of Fig. 2 with several sealed cartons on it.

The inner ends of the two cross conveyors are also shown in Fig 3. It will be noted that these ends turn back toward the tank and that the packages pass over a ball-table from the ends of the conveyors. Beyond the ball-table two straight sections of roller conveyor serve as gathering and counting areas. The ball-table is, of course, used to transfer the ware from the inspection conveyors to the main warehouse conveyor which rises from between the ends of the cross conveyors. It will also be noted that three of the six lehrs pass under and beyond the cross conveyors to inspection stations farther on. Packaged ware from these stations is placed on the cross conveyors by hand. The operator at the gathering and counting station can start the warehouse conveyor when needed and it is also under the control of the operator in the general distribution station at the other end of the conveyor near the warehouse.

The conveyor from No. 6 tank to the warehouse has a 24-in. canvas belt and is carried on a suspended framework throughout practically all of its more than 250 ft. of length, as shown in Figs. 4 and 5. Rising from the gathering and counting station, as shown in Figs. 3 and 4, it immediately traverses a circular space beneath what was formerly the dome of old No. 3 factory. This space is now used largely for machine repair and the conveyor is suspended at such a height that it does not interfere with the movement of machines throughout the area. Just to the north of this space, that is, to the rear of the position from which the views in Figs. 4 and

Fig. 3. The two cross conveyors at No. 6 tank end at a gathering and counting station in the center as shown. The belt conveyor to the warehouse rises from between the cross-conveyor ends.

5 were made, are located the other crystal and opal melting tanks. Products from these tanks are machine-made and are annealed in three lehrs, one of which is larger than the other two.

Fig. 5 shows the conveyor from No. 6 tank passing through a building partition into a second room, in which room the three lehrs just mentioned also discharge their annealed products. The ware from the two smaller lehrs is inspected and packed at the lehrs and passes crossways on a gravity roller conveyor for a distance of some 60 ft., until it reaches a point almost beneath the overhead belt conveyor, then turns to the right and passes on to the general distribution station near the warehouse. A portion of this cross conveyor can be seen through the

Fig. 4. The belt conveyor immediately traverses an area used for machine repair after leaving the inspection points and is suspended at such a height as not to interfere with the tallest machines.

Fig. 5. Showing the suspended belt conveyor passing through several partitions on its way to the warehouse. Through the doorway can also be seen the roller conveyor which brings ware from other production units.

door in Fig 5, with a counterweighted, hinged section that can be raised to permit the passage of ordinary plant traffic.

Fig. 6 is another view near the warehouse ends of these two conveyors, showing how the belt conveyor descends toward the level of the distribution station and passes through the partition, alongside the gravity roller conveyor from the other tanks. Ware which passes through the larger of the three lehrs is not inspected at the lehr and transported on the roller conveyor, but is trucked to the inspection stations shown in Fig. 6, where it is inspected, packed and placed on the roller conveyor.

The manner in which the two conveyors approach the general distribution station is shown in the background of Fig. 7. The belt section of the upper conveyor ends shortly after it passes through the partition and the ends

Fig. 6. Here the two ware conveyors from the production units pass through the final partition before reaching the general distribution station.

Fig. 7. This view of the general distribution station from another direction shows the ware coming from the production department on the two conveyors in the background, the two warehouse conveyors passing off to the right, and cartons for immediate shipment rising on the slat conveyor in the foreground.

of both conveyors consist of gravity roller sections leading to the caster table at which point ware for the warehouse is switched off the main line. Packages which are to go directly to the shipping department are pushed straight along to the power-driven slat conveyor in the foreground, which in turn discharges to gravity roller sections leading to the shipping department and platforms. A readjustment of the shipping platform locations is now under consideration and will, when carried out, necessitate a change in the distribution and shipping department end of the conveyor layout.

Referring again to Fig 1, it will be noted that the two conveyors to the warehouse are of the flat, canvas belt type, the first one (left to right) serving the upper floor and the second the lower. The warehouse is 231 ft. long by 125 ft. wide, and the two belt conveyors enter the building near the center at one end. On the lower floor the incoming belt discharges to a live-roll conveyor which turns to the right along the end of the building and then to the left, traversing the whole length of the building on one side, as shown in Fig 8. The speed of these live-roll conveyors is about 50 ft. per min. At intervals of about 30 ft., sections of gravity roller conveyor switch off from the incoming live-roll line and pass across the building to the outgoing live-roll conveyor at the other side. The length of the gravity roller sections is about 85 ft. At the entering end of each gravity roller section a diverter bar can be set to guide the cartons into the line, the cartons then being piled on both sides of the conveyor, as shown in Fig. 8.

Fig. 8. One of the sections of live-roll conveyor in the warehouse is shown in this view. At intervals gravity roll sections lead to an outgoing live-roll conveyor at the other side of the house.

When ware is to be taken from the warehouse, it is placed on the gravity roller section and discharged to the outgoing live-roll conveyor, which runs at a speed of 63.3 ft. per min. and carries the cartons back toward the end of the building at which they originally entered. Upon reaching the position of the original entrance conveyor the cartons pass to a belt conveyor which immediately rises and transports the cartons above the previously-described incoming live-roll conveyor at the end of the building. Near the building corner the ware is delivered to a gravity roller section which turns to the right and passes out of the building through a door into the shipping department.

The handling of ware on the upper floor of the warehouse is quite similar to the lower floor operations, except that the incoming cartons from the belt conveyor turn to the left and pass down the east wall of the building, instead of along the west wall as on the lower floor. The incoming live-roll conveyor on the upper floor runs at about 46 ft. per min. and the outgoing live-roll conveyor at the other side of the building runs at the same speed. Gravity roller sections connect the incoming and outgoing live-roll conveyors at intervals of about 30 ft. The outgoing live-roll conveyor leads to the front corner of the building and delivers the cartons to a spiral gravity roller system which brings the ware down to the first floor. The lower section of the spiral after it passes through the second floor is shown in Fig 9. The straight section in the background is the outlet of the spiral and leads into the shipping department. The curve and straight section in the lower foreground is the outlet from the lower floor, as previously described, and also leads into the shipping room. At the shipping platform moveable curved and straight roller sections can be arranged to carry the packaged ware right into the railroad car.

Fig. 9. Ware for the shipping department comes down from the upper floor of the warehouse on this spiral conveyor and passes along the straight section in the background. The flat conveyor in the foreground serves the first floor.

In commenting upon some of the factors which must be considered for a successful glass plant conveyor system, Mr. George F. Lang, president of Carr-Lowrey, says that too much attention can hardly be given to the preliminary plans and layouts, not only for proper routing of ware at proper speeds, but also to secure best conveyor locations that form a minimum hindrance to other plant activities. The elevation of the conveyor from No. 6 tank is a case in point. Furthermore, there must be full cooperation between the glass manufacturer and the conveying equipment builder, so that the glass-making requirements shall not be neglected, on the one hand, nor shall all details of available equipment be overlooked, on the other. The equipment for the Carr-Lowrey installation was furnished by the Standard Conveyor Co., Alvay-Fergueson Co. and the Lamson Co.

CHANGES AT NORTH AMERICAN

The North American Refractories Co., Cleveland, Ohio at the Directors meeting held July 31 made the following changes: Ralph F. Hess was elected vice president in charge of operations. Mr. Hess has been production manager since the formation of the company in 1929. Howard H. Hopwood has been elected vice president and general sales manager. Mr. Hopwood has been sales manager since 1936. Stephen M. Swain has been appointed director of research for the company. Mr. Swain has been chief ceramic engineer since 1934. Mr. Earl C. Petrie, who has been doing research work under Mr. Phelps at the American Refractories Fellowship at the Mellon Institute of Industrial Research at Pittsburgh for the last eleven years has joined the research department of the company, effective September 1, 1940.

INVENTIONS AND INVENTORS

Summary of United States Patents of Interest to the Glass Industry Issued During August

Raw Materials

Since the successful introduction of nepheline syenite proved to the material supplier that the glass manufacturer was not hide-bound to feldspar as the source of alumina, there has been a great deal of casting around for new mineral sources. Aplite and kyanite have been investigated and adopted in some instances. In patent 2,210,254 issued to Charles H. Peddrick, Jr., advantages are claimed for a glass batch ingredient comprised of a mixture of pyrophylite and feldspar. Pyrophylite is an alumina-silica mineral containing somewhat more silica than do pure clays. Typical chemical analyses of pyrophylite, of a feldspar, and of two of Mr. Peddrick's mixtures are given in the following table:

	Feldspar	*Pyrophylite*	*Mixture A* ⅔ *feldspar* ⅓ *pyrophylite*	*Mixture B* ⅓ *feldspar* ⅔ *pyrophylite*
SiO_2	69.6	72.7	70.6	71.7
Al_2O_3	17.5	22.7	19.2	21.0
Fe_2O_3	.1	.1	.1	.1
CaO	.8	.2	.6	.4
K_2O	8.4	...	5.6	2.8
Na_2O	3.4	.3	2.4	1.3
Loss	.2	4.0	1.5	2.7
	100.0	100.0	100.0	100.0

This patent was assigned to Feldspathic Research Corp. of New York.

Furnaces

A patent granted August 20 to Boyd H. Weekley of Shreveport, La. (2,212,358 to Libbey-Owens-Ford Glass Co.), is concerned with removal of the loose dust which rises from the batch fed to the doghouse and does damage to the refractories in the furnace and checker chambers. The preferred arrangement is shown in Fig. 1. A circulation of air is set up in the doghouse which carries away the dust through an exhaust pipe which extends upward from the doghouse hood or cover.

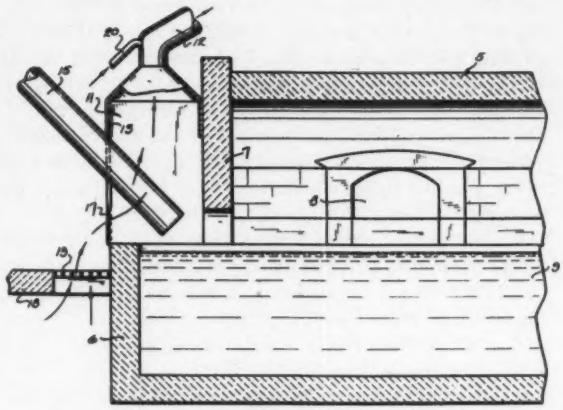


Fig. 1. Weekley: 2,212,358. To carry away the loose dust rising from the batch entering the doghouse through chute 15, an air circulation is set up through a chain heat shield 17, and moved upwards through a hood to an exhaust stack 12. A principal object is to increase the life of refractories in the furnace superstructure and in the checker chambers, where dust does much damage.

Feeding, Forming and Shaping

Frederick W. Duhan of Crown Cork & Seal Co., Inc., Baltimore, Md., was granted patent 2,210,203 for ap-

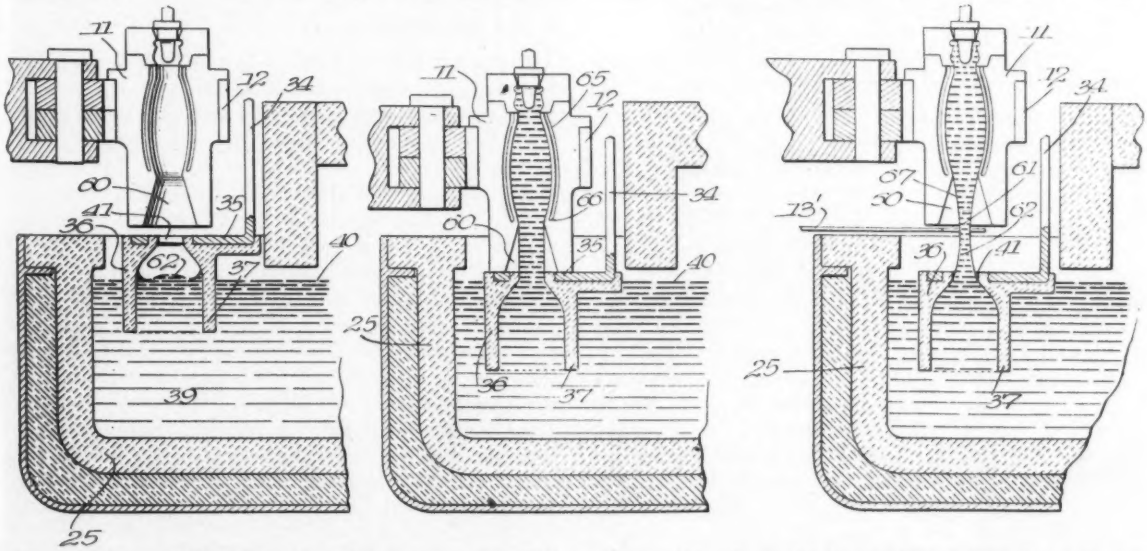


Fig. 2 Duhan: 2,210,203. In this apparatus for filling suction molds, the mold is not dipped into the gathering pool. Instead, its lower face registers with the upper surface of a conduit 36 which has its lower end continuously immersed in the pool; the mold and conduit member are then lowered together, and suction applied to the upper end of the mold fills it with glass. In the right hand view, the mold has been raised so as to cause the glass to neck preparatory to being severed by shears, 13. The conduit member then rises to the position shown at the left allowing the glass to retract to a position where cooling is prevented.

paratus and method for filling suction molds. As has been the case in other improvements directed at this process, the aim was to correct such effects as the corrosive action on the bottom of the mold when it is dipped into the supply pool, its excessive heating, and the chilling of the glass in the area around the mold. The latter chilling effect has led to the use of complicated apparatus to circulate the glass in the forehearth, or to arrange to have successive charges gathered at different points. In Duhan's new apparatus, the mold is not dipped into the surface of the pool, but merely comes to rest upon a delivery conduit member which remains in the glass. The process is shown more clearly by Fig. 2.

Crown Cork & Seal Co. also received through assignment by Thomas F. Pearson of Pontefract, England, patent 2,212,699 for an apparatus for opening and closing the molds of a machine for forming glassware.

A crucible glass feeder was patented by Clyde C. Cook and David W. Cook of Clarion, Pa. (2,210,617). Directing their improvement toward elimination of the channeling which produces cords, they offer a novel construction which provides for the glass to be fed from the crucible until it is completely drained.

Patent 2,210,583 issued to Kenneth M. Henry, Maumee, Ohio (Owens-Illinois Glass Co.), relates to electrically-heated mold parts especially designed for glass block forming machines. Particular difficulty is said to have been experienced with the mold ring which surrounds the die in which the half-sections are pressed, and shapes the upper rim of the article. The heat provided to the ring by conduction from the glass has not been uniform enough, and the ring commonly tends to run cold. To overcome these limitations, Mr. Henry designed an electrical heating unit which is said to give uniform and adequate heating. The unit includes in the mold ring a relay circuit (including a thermostat) supplying heating current to the heating elements. In one modification of the invention, heating elements placed at mold corners are selectively controlled by individual thermostats.

A superior alloy for the molding surface of glass molds which will resist oxidation and is said to minimize sticking, was patented by Wm. McKain Greed of Washington, Pa. This is patent 2,212,984 assigned two-thirds to J. Alvin Weirich. A typical composition is 70 per cent nickel, 27 per cent copper and 3 per cent tin.

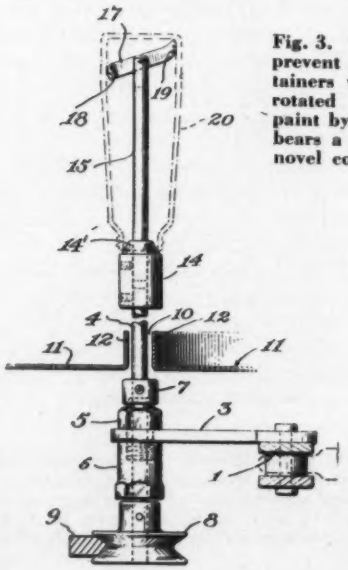


Fig. 3. Ross: 2,210,187. To prevent the wobbling of containers while they are being rotated for application of paint by spraying, the rod 15 bears a steadying arm 17 of novel construction.

Miscellaneous Processes

To avoid the wobbling of bottles while they are being rotated for the application of sprayed paint or other coatings; James W. Ross of Washington, Pa. (Hazel-Atlas Glass Co.), has designed the stabilizing unit shown in Fig. 3 (patent 2,210,187). The unit provides a stem inside the bottle with a gripping arm which engages the sides of the container.

Dr. Jesse T. Littleton of Corning Glass Works received patent 2,212,162 for a method of making a glass screen for filtering acids and other corrosive liquids. Platinum gauze has been used for this purpose, as have various forms of sintered glass, but the latter may not have uniform filtering characteristics. Littleton immerses a metallic screen in a bath of molten glass, and after withdrawing the screen, allows the surplus glass to drain away. Any meshes bridged by a film of glass are cleared by allowing a flame to play on them.

Westinghouse Electric and Manufacturing Co. was assignee of Michael E. McGowan's patent 2,212,842 for a machine for sealing-in and moulding lamp bulbs. Particularly it concerns the operation of uniting the stem or mount, including a glass flare tube, to the neck portion of the bulb. The heart of the invention is a circulation of air into the bulb during the operation, in such a manner that the preheating step before sealing is eliminated. The air which passes the bulb surface directly in contact with the sealing flames is slightly warmed and the bulb immediately absorbs some heat from the air. As the temperature of the bulb is raised, the circulating air dissipates sufficient heat to prevent the formation of internal stresses which might crack the bulb.

Patent 2,212,179 granted to Joseph H. Martin of Roanoke, Va., is a machine for grinding lenses.

Sheet and Plate Glass

Patent 2,210,193 granted to L. A. Aillaud of San Diego, and assigned in part to Vonda Aillaud and Ambrose Ferrari, is a glass cutter for manual use. Robert F. Hall of Ajo, Ariz., patented a sheet glass snapping implement (2,212,599).

William Owen of Pittsburgh, assigned to Pittsburgh Plate Glass Co., his patent 2,213,014 for a clamp for suspending glass plates, which grips the glass by the action of a permanent magnet in each arm of the clamp.

In the continuous system for surfacing glass sheets to produce plate glass, the individual sheets are bedded in wet plaster of paris. To hasten the set of the plaster at the edges of the sheets, it has been customary to apply dry plaster of paris manually in these areas. An apparatus for applying the dry powder automatically has been patented by John Moran and Michael N. Keplar of Toledo. This is patent 2,212,351 assigned to Libbey-Owens-Ford Glass Co.

Glass Wool and Fiber

An improved method of making glass fibers patented by Piero Modigliani of Rome, Italy (2,212,448), was assigned to Owens-Corning Fiberglas Corp. The nucleus of the invention is the plan to heat a small stream of

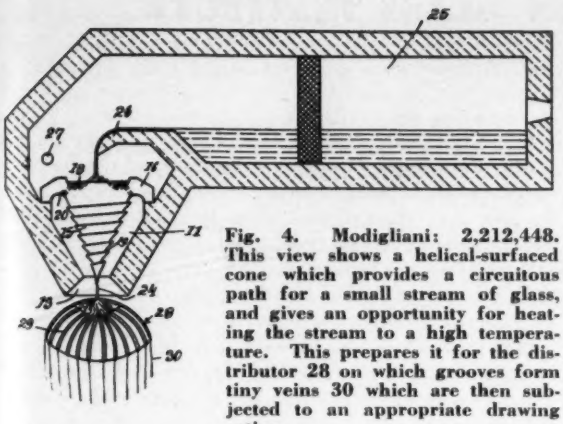


Fig. 4. Modigliani: 2,212,448. This view shows a helical-surfaced cone which provides a circuitous path for a small stream of glass, and gives an opportunity for heating the stream to a high temperature. This prepares it for the distributor 28 on which grooves form tiny veins 30 which are then subjected to an appropriate drawing action.

glass after it has flown from the supply pool along a circuitous path leading to the point where drawing takes place. It is claimed that the very finest fibers are easily produced by this method. Other details are illustrated in Fig. 4.

Owens-Corning Fiberglas Corp. was assignee also to Games Slayter's patent 2,212,528 for a method and apparatus for melting and fining glass, particularly for making fibers. It is stated that the novel electric furnace which constitutes this invention produces with a very small furnace, the same tonnage as is produced on much larger furnaces of orthodox design. As illustrated in cross-section in Fig. 5, the side walls and bottom are made of normal refractories. The electrical resistors 14 and 15 (platinum-rhodium alloy) serve as heating elements for melting and refining the batch. The outer heating element 14 serves primarily for melting the batch, while the inner element 15 serves as the fining element. The element 14 forms a housing which is complete except at the lower end where it is open and spaced above the floor. The batch is melted as it moves downward along the heating element 14, and the melted glass flows upward in the narrow space between this element and the fining element 15. This is a zone of high temperature in which seeds are quickly melted. The top of the element 15 is provided with many small holes 15a through which the glass escapes (and which screen out seeds) to form a pool or supply body of glass at 41, from which it is drawn. A stack, 17 allows gases to escape. The thoroughness with which the furnace is designed to escape heat losses, is an evident feature.

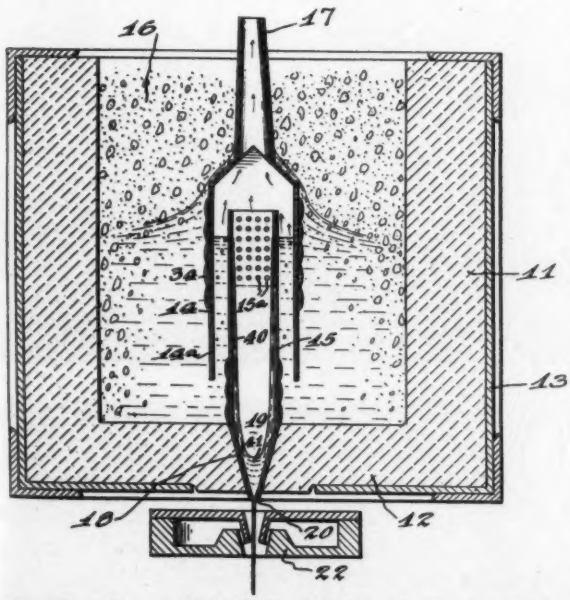


Fig. 5. Slayter: 2,212,528. Electric furnace for making glass for fibers and other products. See discussion.

Games Slayter was also granted a patent 2,210,958 (Owens-Corning Fiberglas Corp.) for the use of a small "breathing tube" to be applied to pipes covered with insulation to allow water condensation to escape.

Plastics

Clauss B. Strauch of New York obtained patent 2,210,509 (Hartford-Empire Co.) for a method of forming sheets of plastic material over objects, as in covering a capped bottle with cellulose acetate sheeting.

Lawrence G. Hileman received a patent 2,210,584 (Owens-Illinois Glass Co.) for an apparatus to be used in polishing and cleaning plastic articles such as bottle caps.

Another Owens-Illinois patent involving plastics was 2,212,483 granted to Leonard D. Soubier and John R. Hoge of Toledo. This patent concerns a means of preparing a measured charge of a moldable resinous material for forming bottle caps, etc.

CITY ENGINEERS LEARN USES OF GLASS IN BUILDING CONSTRUCTION

New York City Department of Public Works will conduct a dinner at Longchamps Restaurant, 253 Broadway at City Hall, New York City, on Tuesday, October 1 at 6 p.m. A feature of this dinner will consist of a series of talks on the subject of glass for buildings. Arrangements have been completed for a discussion of flat glass for building purposes by A. W. Varasse of the Pittsburgh Plate Glass Company. John Kohl, director of Glass Engineering Department, of the Pittsburgh-Corning Corporation, will discuss "Glass Block, It's Suitability, Adaptation, Method of Design and Installation for Buildings." Mr. Jan S. Irvine, mechanical engineer and New York Manager of the Owens-Corning Fiberglas Corporation, will discuss "The Development and Use of Fiberglas from its Inception."

Two hundred and fifty people are expected. This dinner and lecture is being conducted by and for the employees of the Engineering Division of the Department of Public Works, also, the consulting architects and engineers who are involved in the design and construction of public buildings for New York City. The Hon. Irving V. A. Huie, Commissioner of the Department, will act as master of ceremonies introducing the principal speakers. William S. Elliott, Engineer of Tests, Department of Public Works, is in charge of arrangements.

WANTED: Sales engineer, high-type. Must be Ceramic Engineer, experienced. Should be capable of selling and handling field operations in decorating and glass industry. All applications strictly confidential. Box 36, The Glass Industry, 11 West 42nd Street, New York City.

MEETING OF THE SUN GLASS INSTITUTE

The Sun Glass Institute held its bi-monthly meeting on September 13 and 14 at the Summit Hotel in Uniontown, Pa. The principal business of the meeting, held on Saturday, was the consideration of plans for the certification of sun-glass lenses, so as to afford the consuming public next season with a means for identifying lenses of approved quality—whether blown and drawn or ground and polished. An election of officers resulted as follows: Mr. T. A. Willson of Reading, Pa. was reelected as president and Mr. J. C. Foster of Leominster, Mass. as vice president.

The members attending were given the opportunity of visiting the L. J. Houze Convex Glass Co., which is located at Point Marion, Pa., a few miles from Uniontown. The Houze Company is a member of the Institute and is an important producer of sun-glass leases: in fact it is the only plant of its kind in the United States producing colored goggle glass at this time. The company manufactures the large glass balls that are cut up into goggle lenses and other blown window glass specialties. One interesting feature seen at the factory is the furnace system in which the individual pot or tank is hooked up in units of four or more with a common stack, instead of the old type where any number of pots could be used. This feature enables the glass man to heat each individual color in its own peculiar requirements, instead of draw-

Members of the Sun Glass Institute about to start on their trip through the plant of the L. J. Houze Convex Glass Co. The Houze factory is one of the important producers of goggle glasses in the country.

The group gathers around a worker who is gathering glass for a goggle ball. These balls are subsequently cut up into individual pieces from which goggles are made.

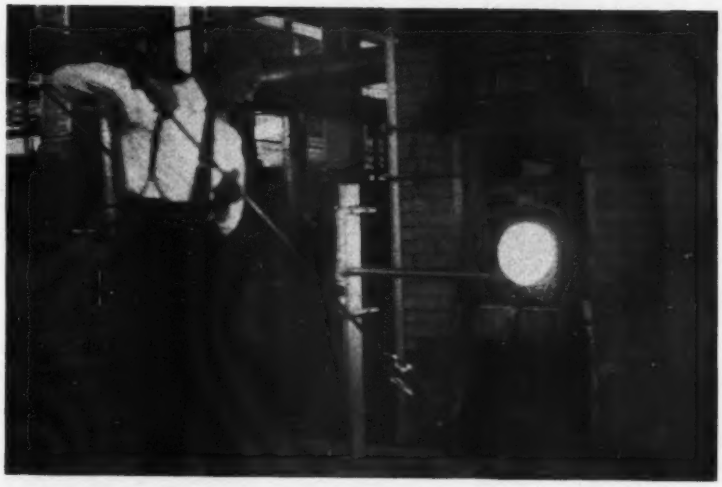
A. O. Boniface, T. A. Willson, Roger Houze and Ross Purdy checking samples of glass.

ing fire when working a pot next to one just filled which requires a lot of heat.

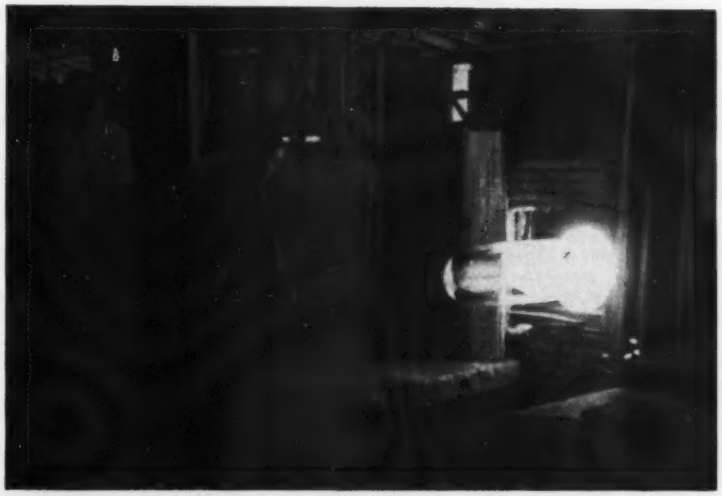
After the plant trip, a visit was made to Friendship Hill, the historic home of Albert Gallatin, Secretary of The United States Treasury under Thomas Jefferson and James Madison, Minister to France and Minister to England, and the controlling person in negotiating and concluding the Treaty of Ghent which closed the War of 1812. He was also the first man in the United States to make glass west of the Allegheny mountains. This visit was followed by a dinner party given to the members of the Institute by the Houze organization at which about 30 were present.

A Belgian workman gathering glass for one of the large balls.

Armand Houze, Jr. and Leon Houze watch J. Willson try his hand marvering a gather. Mr. Willson's great-grandfather is reported to have started the optical glass business in America.



Armand Houze, Jr., making a test. The present generation of the Houzes has retained the same skill in glass making for which this family has been famous for many years.



Showing how window glass is made by hand. This is one of the few factories in America where one can still see window glass made by this old-time method.

CHEMICAL SOCIETY'S GLASS SYMPOSIUM

The 100th national meeting of the American Chemical Society was held in Detroit September 9 to 13. Eighteen of the Society's professional divisions met and numerous papers were presented dealing with practically every major field of chemical science and industry.

The symposium on "Glass—What Is Old? What Is New?" under the chairmanship of Dr. Alexander Silverman got underway Tuesday afternoon, September 10. Dr. Silverman in his introduction covered a general comparison of the old and new in fiber glass; in laboratory ware; illuminating glassware and fluorescent lighting; water glass; window and plate glass; structural glass including plate, hollow tile, and cellular glass; case hardened or tempered ware; and laminated glass; silvering and decorative processes; table ware; optical glasses; glare elimination; absorption and transmission of special radiations; and glasses for signal lighting. After some attention to chemical and physical characteristics of glass, reference was made to the application of art and glass to art. New trends concerning structures were indicated. Reference was also made to refractories in their relation to glass manufacture.

Summaries of the papers given at the glass symposium follow:

Calculations of Physical Properties of Silicate Glasses from Their Chemical Compositions. *By Dr. Maurice L. Huggins, Research Laboratories, Eastman Kodak Company.*

Glass is not a definite chemical substance, with fixed characteristics. Different specimens of glass vary widely with respect to their composition, the kinds and relative numbers of the atoms of which they are composed—and so with respect to such characteristics as their density and their index of refraction, the degree to which light is bent on entering or leaving the glass.

In the past, many attempts have been made to relate the characteristic properties of glasses with their compositions, but with only partial success. The relationships seemed to be quite complex and to a considerable extent unpredictable. Now, however, Dr. M. L. Huggins of the Research Laboratories of the Eastman Kodak Company has shown that the relationships are really quite simple, provided one consistently calculates both compositions and properties for that amount of glass which contains one oxygen atom.

With a small number of constants, calculated by Dr. Huggins for the elements commonly present in glass, one can now compute quite accurately the densities and refractive indices for light of any desired color of glasses having a wide variety of composition. It is no longer necessary to make a complex glass in order to know what its properties would be.

Obviously, these results should prove of considerable use in practical glass manufacture. In addition, Dr. Huggins' work leads to certain interesting conclusions regarding the structure of glasses of different types. In agreement with theoretical predictions and with previous X-ray studies of crystalline silicates and silicate glasses, he concludes that many of the characteristics of a glass depend primarily on the ratio of the number of silicon atoms to the number of oxygen atoms, hence on the distribution of silicon and oxygen atoms in the structure—in small groups of atoms, in rings or chains, in sheets, or in complex three-dimensional arrangements.

Certain complications are found for glasses containing boron atoms, but these are readily explained by the assumption (also in agreement with theoretical expectation and with the X-ray results) that some of the boron atoms have three close oxygen atom neighbors, while others have four.

Chemical Trends in Glass Technology. *By Henry H. Blau, Corning Glass Works.*

Recent chemical trends in the technology of inorganic glasses have been characterized by a great rate of advancement rather than by changes of direction alone. Such developments may be logically divided into two groups, namely: those arising from the chemical relations in the formation or production of glasses, and those associated with the uses or applications of glasses.

Revolutionary changes in glass products and methods of fabricating them have given rise to correspondingly radical revisions of the chemical approaches to the resulting problems. Although in many cases changes of form, requirements and physical processes have imposed added chemical limitations, in other cases these same factors have greatly extended the ranges of chemical methods and compositions which can be employed. In addition to these revisions of viewpoint which have originated outside its distinctive field, glass chemistry has continued in the application of its own ingenuity and initiative in the seeking of old ideals.

For most purposes, pure silica glass is still considered as the ultimate goal of the glass maker. Although glasses containing about 80 per cent of silica had constituted the previous commercially attainable limit, glasses containing 96 per cent of silica have been developed on a basis which surmounts the former obstacles of almost prohibitive costs and limitations of forming so viscous a composition. The production of these glasses involves a quite novel manufacturing procedure, in which many of the processes are of the type common to lower temperature chemical processes, thus bringing glass manufacturing closer in some of its methods to other parts of the chemical industry.

Modern science, engineering and industry have imposed many new and stringent demands on glass chemistry. Interesting examples of this are found in the need for glasses capable of transmitting or absorbing radiant energy of specific ranges of wave lengths in the invisible as well as visible regions of the spectrum. The production of these has not only involved the use of new compositions but also the making of much purer glasses.

The glass chemist's age-old efforts to eliminate or minimize the contents of such impurities as the oxides of iron and titanium have been extended so much that commercial glasses containing less than 0.01 per cent of ferric oxide have been attained. The use of similar methods has made possible the production of decorative glassware of astonishing crystal clarity and purity.

More rigid requirements for the resistance of glass to chemical attack have also been presented. There has been a wider and more intelligent appreciation of the need for freedom from possible contaminations arising from the solubility of glassware in the laboratory. This has been extended to equipment for chemical plants and the containers for the storage or shipment of chemicals, pharmaceuticals, liquors and food-stuffs.

Economic limitations have also influenced the revisions of chemical compositions and the adoption of new raw materials. Thus glass chemistry is not only meeting the demands of a rapidly changing civilization and economy, but is also taking the initiative in the development of new and improved compositions and products.

Optical Characteristics of Glass. *By Dr. H. R. Moulton, American Optical Company.*

This report describes the development of this glass from the crude, streaky, discolored glass of the earliest glass makers through to the modern colored glasses which are in effect designed for the transmission desired.

Present day glasses depend for their desirable optical properties, such as color, absorption of unwanted radiation, and index of refraction or light bending power, upon the growth of chemical knowledge and the increasing availability of raw materials.

(*Continued on page* 452)

NEW EQUIPMENT AND SUPPLIES

PACIFIC COAST BORAX CO. MARKS 50TH YEAR

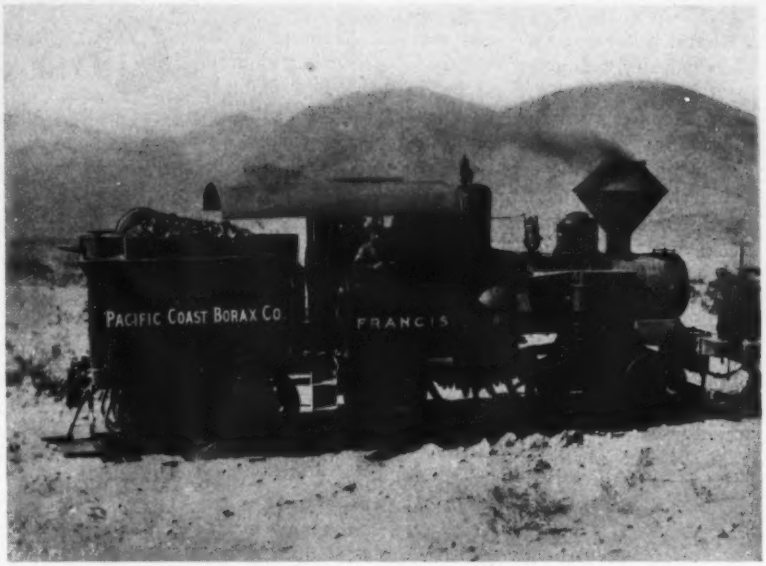
Pacific Coast Borax Co. celebrates this month its fiftieth anniversary. The roots of the company, however, actually go back somewhat further in point of time —to a day in 1881 when an aging prospector, Aaron Winters, together with his half-Spanish wife Rosie, discovered some borax deposits in the desert marshes of Death Valley. Trembling with hope, Winters fired the chemical used to identify Borax, then shouted, "She burns green, Rosie!" Winters sold his claim to interests that were incorporated in the Pacific Coast Borax Co. in October, 1890. In those days the material was actually transported over 160 miles of blistering desert by twenty-mule-team trains, and from this activity arose the 20-mule team trademark which has become familiar throughout the country.

As an ingredient of glass, borax has been used for many years, but with the onset of lower prices its use as a minor ingredient has increased largely in later years, particularly in the field of container glasses. Its particular value is its fluxing power. Substitution of borax for part of the soda not only lowers the expansion coefficient, but also increases chemical durability. The average amount of borax in the batch is usually enough to yield about 0.7 per cent B_2O_3 in the glass. Many manufacturers also report an improved appearance of the product, from the standpoint of brilliance and finish. Special glasses of the heat-resisting type use borax in greater proportions.

To the glass industry, therefore, the 50th anniversary of one of its major suppliers of glass-making materials is of interest. During the past 50 years the Pacific Coast Borax Co. has developed mining and refining methods for ore deposits located in various places in and about the Death Valley territory. In 1927 the company moved to its present location at Boron, near Kramer, California, more convenient to the seaboard, where a large deposit of borate of soda known as Rasorite had been discovered by C. M. Rasor, the company's field engineer. From the calcining plant at Boron, borax ore today is transported to one of the country's largest borax refineries at Wilmington, Cal., where it is refined, manufactured into 20 Mule Team products, and shipped throughout the world.

CATALOG & BULLETIN SERVICE

Current catalogs and manufacturers' service bulletins reviewed in this department may be obtained by writing to THE GLASS INDUSTRY.



"Francis," not a modern beauty, but a frontier gal possessed in full measure of the strength and fortitude of the pioneer. For years Francis hauled tons of borax to the most famous mules in history, The 20 Mule Team.

CATALOGS RECEIVED

Bailey Meter Co., Cleveland, Ohio. Bulletin 107-A. Pressure reducing and desuperheating control of the air operated type is illustrated and explained in this new bulletin. It contains diagrammatic arrangements, installation photographs and detailed photos of individual control units. A partial list of installations includes data for each application listed.

Bacharach Industrial Instrument Co., Pittsburgh, Pa. Bulletin 337 on their "Fyrite" CO_2 Indicator. This portable instrument is used for measuring the percentage of CO_2 in the exhaust gases from furnaces and other heating equipment.

Leeds and Northrup Co., Philadelphia, Pa. Catalog N-01A-600, "Furnace Pressure Control for Metallurgical and other Industrial Furnaces," describes the general advantages of controlling furnace pressure automatically. Specific information may be obtained from any of the L & N offices.

Chas. Taylor Sons So., Cincinnati, Ohio. Bulletin 505. The manufacturers have announced a new bulletin concerning Tayco-40 Cement for bonding silica brick.

Corning Glass Works, Corning, N. Y. No. LP-18. "Pyrex" Brand Fritted Glassware. These filter discs are made in three porosities, and it is claimed it is possible to cover chemical filtration and precision in porosity control.

POMONA VERTICAL PUMPS

The Pomona Pump Company, 556 East Commercial St., Pomona, California, announces the complete redesign of its line of 6 inch medium capacity vertical turbine pumps. As a result of improved engineering practice, particularly in the newly designed impellers and seats, the manufacturer states that the new models afford higher efficiency and better performance.

For a desired capacity of 100 G.P.M. against 110 ft. lift in a well and 50 lbs. pressure above, a 7½ H.P. motor is required, as against a 10 H.P. motor with the old model. The efficiency of this particular size pump for this head capacity has been increased 6½ points, the number of stages has been reduced one-fourth and the initial cost of the entire unit lowered 20 per cent.

Other advantages of these pumps lie in the facts that they are water-lubricated, with no stuffing box below ground level; that the specially-designed semi-open impeller can be adjusted from the surface for wear and for changing capacity; and that they are non-sandlocking and non-gaslocking. Constructed of high quality bronze, the semi-open impellers operate in a cone-shaped seat in the pump bowls. Correct curvature of the impeller vanes assures maximum lifting capacity and prevents overloading of motor regardless or changes in water level.

The manufacturer states that Pomona pumps are made in every type and size of vertical pump, from the small domestic pump delivering only a few gallons per hour to the large Niagara type, delivering 100,000 gallons per minute or more. Write for Bulletin 26.

CURRENT STATISTICAL POSITION OF GLASS

August witnessed the usual seasonal increases in the glass industry with gains reported in production, employment and payrolls; exports reached a record monthly high as imports dropped to a new low. According to GLASS INDUSTRY's Production Index output during August increased 10 per cent over July to $31,000,000; the January-August total approached $233,000,000 which was 15 per cent above last year's level.

Plate glass production during August totalled 12,533,437 square feet according to the Plate Glass Manufacturers of America. This was an increase of 47 per cent over July, in line with the usual seasonal trend and was 20 per cent more than the figure reported for August of last year. Cumulative figures for the January-August period place this output at 96,660,000 square feet which is 32 per cent greater than 1939's comparable total.

Window glass production during August dipped less than 1 per cent below July's total to 992,906 boxes, establishing a counter-seasonal trend. However, this compares favorably with August of 1939 when a total of 867,000 boxes was reported. During the first 8 months of 1940 window glass output amounted to 8,606,000 boxes which represents an increase of 34 per cent over last year.

Glass container production during August totalled 5,070,464 gross according to the Glass Container Association. This was an increase of 6 per cent over July 1940 and August of last year. On an 8 month basis 1940's output of glass containers amounted to 36,556,000 gross or 8 per cent above last year's level. Shipments during August totalled 4,653,030 gross—an increase of 3 per cent over July but 2 per cent before August 1939. The January-August shipment total for 1940 was 35,303,000 gross as compared to 33,738,000 gross in 1939 which indicates an 8 per cent gain. 1940 glass container production is running within 1 per cent of 1937's record totals and shipments are within 2 per cent of that year's comparable figures.

Stocks on hand at the close of August totalled 9,654,538 gross—a gain of 3 per cent over the previous month and 13 per cent more than the August of 1939 total.

Miscellaneous glass products manufactured during August were valued at $10,000,000 according to reliable estimates. This was an increase of about 10 per cent over the previous month and the same month of 1939. Output was particularly large in the handmade tableware branch, where orders for holiday goods are being anticipated. Technical and scientific lines have been stepped up considerably as a result of the National Defense Program.

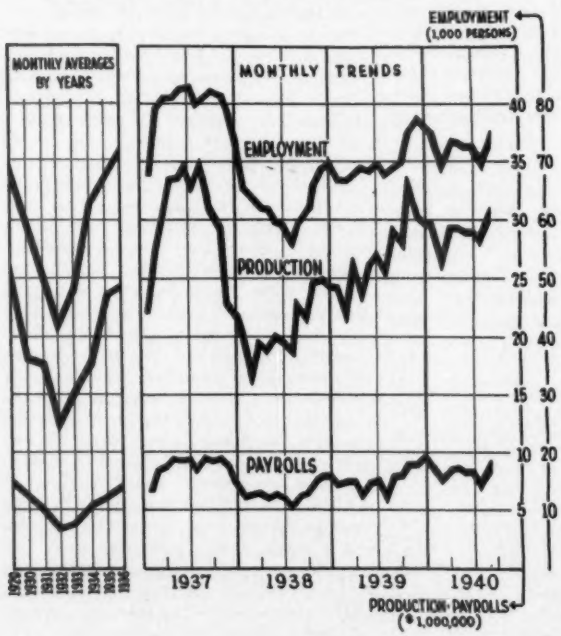
Employment and Payrolls: It is estimated that 75,500 persons were employed in the glass industry during August as compared to 71,400 the previous month and to 68,800 in August of last year.

Payrolls during August totalled $8,600,000—an increase of 13 per cent over July and 12 per cent over August 1939. During the first 8 months of 1940 glass manufacturers paid out almost $66,000,000 in wages; last year's comparable total was $58,000,000.

Foreign Trade: Exports were valued at $1,245,000—an increase of 5 per cent over July and 60 per cent over August of last year. All lines shared in the rise over

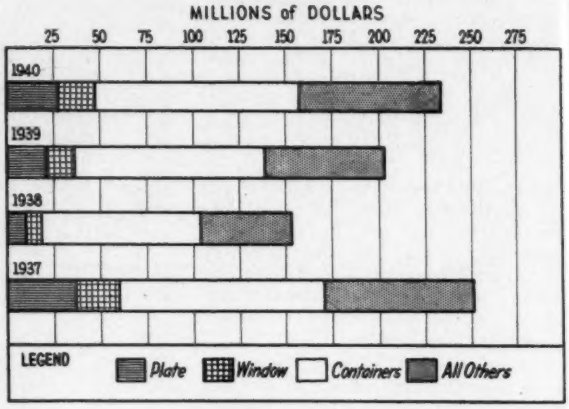
GI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through August, 1940



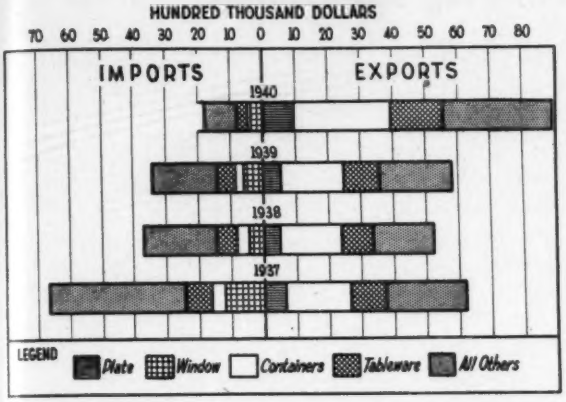
GI THE GLASS INDUSTRY'S INDEX

Production for Eight Months, January Through August



THE GLASS INDUSTRY'S INDEX

Foreign Trade for Eight Months, January Through August



last year's comparable month as window glass led the list with a 1767 per cent increase; a July-August increase of 34 per cent in container sales was largely responsible for the industry's gain during that period; declines were reported for tableware, plate and window glass. An analysis of January-August totals reveals an increase of 53 per cent over last year as 1940's sales approach the $9,000,000 mark. All types of glass are being exported in large quantities this year.

Imports dipped 9 per cent below July's total and 60 per cent below August 1939 to $175,000. While the trends were not uniform in degree, all lines experienced declines. There were still some withdrawals from warehouses included in these figures but it is expected that warehouse stocks will be depleted soon, bringing import statistics down to new lows reflecting actual arrivals. There were no imports of plate glass reported; tableware volume dropped to $18,000—the smallest total in recent years. During the first 8 months of 1940 imports of glass were valued at $1,806,000 representing a drop of 47 per cent from the 1939 figure. Plate glass, with an increase of 159 per cent was the only item that did not decline during this period.

PERSONNEL CHANGES

Mr. I. G. Fowler, for the past three years Assistant general manager of the Ottawa, Ill., plant of the Libbey-Owens-Ford Glass Co., was transferred to the general engineering division at Toledo, October 1. Mr. Fowler's new duties will include special engineering investigation with particular reference to production problems. L-O-F is proceeding rapidly with plans and preliminary activities for its new continuous plant at Rossford.

Mr. C. H. Curry, president of Kopp Glass, Inc., has announced the appointment of Harry F. Thorne as general sales manager in charge of sales of industrial, specialty and illuminating glassware. Mr. Thorne, who is a director of the company, will make his headquarters at 1 East 42nd St., New York City. He will also maintain an office at 205 West Wacker Drive, Chicago.

At the Owens-Corning Fiberglas Corp., the following changes have been made: John H. Thomas is now assistant general sales manager. He also continues to be manager of the Fabrics Division. His position as manager of the Research Laboratories was filled at the time of his leaving by Mr. T. R. Simpkins who continues in that job. Jan S. Irvine, formerly sales manager of the Equipment Division, is manager of the New York office, having taken over the job on July 1. Harold Perrine, former manager of the New York office, is now located in the Washington office and is Field Coordinator of the Federal Division. Mr. W. R. Sykes, formerly a member of the Industrial Insulation Department, became manager of the Philadelphia office, covering that city and surrounding territory which was formerly a part of the New York territory. Mr. E. E. French, formerly on assignment from the Toledo office, became manager of the Detroit office, replacing D. S. Smith, who is now in charge of the Minneapolis office. Mr. H. R. Hogendobler, formerly in the Electrical Insulation Sales Department, became manager of the Cincinnati office, replacing Mr. W. W. Allen, Jr., who is now in charge of the Buffalo office.

UNITED STATES FOREIGN TRADE IN GLASS
(VALUES IN THOUSANDS OF DOLLARS)

	1940			1939		Percentage Changes		
	August	July	Eight Months	August	Eight Months	July-August	August-August	Eight Months
EXPORTS								
Plate	96	202	999	66	537	— 52	+ 45	+ 86
Window	56	91	268	3	27	— 38	+1767	+892
Containers	443	331	2931	258	1938	+ 34	+ 72	+ 51
Tableware	168	195	1542	133	1134	— 14	+ 26	+ 36
Illuminating Ware	63	53	459	36	270	+ 19	+ 75	+ 70
Others	419	312	2680	281	1901	+ 34	+ 49	+ 41
Total	1245	1184	8879	777	5807	+ 5	+60	+ 53
IMPORTS								
Plate	...	1	109	5	42	—100	— 100	+159
Window	45	52	317	62	600	— 13	— 27	— 47
Containers	13	13	116	24	239	....	— 46	— 51
Tableware	18	26	354	76	588	— 31	— 76	— 40
Illuminating Ware	6	3	49	32	309	+100	— 81	— 84
Others	93	97	861	244	1637	— 4	— 62	— 47
Total	175	192	1806	443	3415	— 9	— 60	— 47

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	43.00	46.00-49.00
Reduction on precipitated material, $5.00 a ton			
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_710H_2O$)	lb.	....	....
Granulated	In bags, lb.	.0215	.027 -.0295
Powdered	In bags, lb.	.024	.0295-.032
Boric acid (H_3BO_3) granulated	In bags, lb.	.048	.054 - .0565
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07¼
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0865-.0875	.0925
Synthetic (Artificial)	lb.	No supplies available.	
Feldspar—(published list prices)			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	30.00-31.00	....
In bags	ton	31.60-32.60	42.00-45.00
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.074	....
In 5 Ton lots	lb.	....	.0775
Less than 5 Tons	lb.	....	.0825
Lime—			
Hydrated ($Ca(OH)_2$-MgO) (in paper sacks)	ton	8.50	8.50
Burnt (CaO-MgO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	9.00
Burnt, ground, in 180 lb. drums	Per drum	1.60	1.70
Kiln Dried ($CaCO_3$-$MgCO_3$) 10x30 mesh	ton	1.75	....
Kiln Dried ($CaCO_3$-$MgCO_3$) 16x120 mesh.	ton	1.75	....
Nepheline Syenite, f. o. b. shipping point	ton	12.50	14.50
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4)	ton	18.00-20.00	25.00
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls	Per 100 lb.	....	2.50-2.90
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.44	1.465
100 lb. bags		1.475	1.50

Special Materials

		Carlots	Less Carlots
Aluminum hydrate (Al $(OH)_3$)	lb.	.026-.029	.04
Aluminum oxide (Al_2O_3)	lb.	.07	.09
Antimony oxide (Sb_2O_3)	lb.	.14	.14½
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03¼	.03¾
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	Open price.
Pyrophyllite, (20% Al_2O_3)	ton	9.00	12.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.08¼	.08½-.09
Tin Oxide (SnO_2) in bbls	lb.	....	.54
Titanium Oxide (ceramic grade)			
In bags	lb.	.12	.12¼-.12¾
In barrels	lb.	.12¼	.12½-.13
Zinc Oxide (ZnO)			
American process, Bags	lb.	.06½	.06¾
White Seal, 150 lb. bbls	lb.	.09	.09¼
Green Seal bags	lb.	.08¼	.08½
Domestic White Seal bags	lb.	.08¾	.09
Red Seal, bags	lb.	.07¾	.08
Zircon			
Refined Granular (Milled .01-.02c higher)		.06½	.07-.08

Coloring Materials

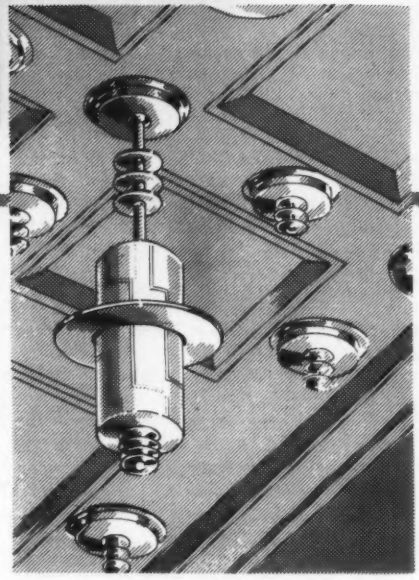
		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.40-1.60
(Commercial, 25% Selenium)	lb.	....	.85
Cadmium sulphide (CdS)	lb.	....	1.00-1.05
Cerium hydrate—			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green, 400 lb. bbls.	lb.	....	.22-.25
Chromite (99% through 200 mesh)	ton	41.00	45.50
Chromite ore (air floated)	ton	55.00	58.00-73.00
Cobalt oxide (Co_2O_3)			
In bbls. 350 lbs. or more,	lb.	....	1.84
Less than 350 lbs.,	lb.	....	1.94
Copper oxide—			
Red (Cu_2O)	lb.	....	.165
Black (CuO)	lb.	....	.18-.19
Black prepared	lb.	....	.22
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.05-.09½
Black (Fe_3O_4)	lb.	.04½	.09
Iron Chromate	lb.	....	.035-.05
Lead Chromate ($PbCrO_4$) in bbls.	lb.	....	.135
Manganese, Black Oxide (Caucasian)			
In Paper bags	ton	70.00	73.00
In Burlap bags	ton	71.75	74.75
In Casks	ton	74.00	77.00
Neodymium oxalate, 50 lb. drums	lb.	....	3.50
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.37
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals and Granular	lb.	.08¾	.09-.09¼
Powdered	lb.	....	.09½-.09¾
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.19-.24
Rare earth hydrate—			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	1.75
In lesser quantities	lb.	....	1.85
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¾	.07-.07¼
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.08¼	.08¾-.08¾
Sodium selenite (Na_2SeO_3)	lb.	....	1.50-1.65
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.75-1.85
Yellow	lb.	....	1.75-1.85
Sulphur (S)—			
Flowers, in bbls	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls.	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.65-2.75
Yellow orange	lb.	....	1.75-1.85

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	.063	.07
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	.... } open	
0, 0½, ½, 1	lb.	.... } price	
Putty Powder	lb.	Open price.	
Rotten Stone, (Domestic)	lb.	.02¼	.03½
Rouge, Red	lb.	....	.16
Black	lb.	....	.18

"CERAMIC"

WEATHER RESISTING *Enamels*



FOR MODERN LIGHTING UNITS

Subject to changing climatic conditions the year round, vitrifiable enamels used in modern lighting units must be able to "take it".

"Ceramic" Weather Resisting Enamels, developed in our laboratory to incorporate maximum weather resistance, workability and desirable transfusion, and controlled through production to maintain these qualities, fulfill this requirement. They meet fluctuating humidity, temperature and air changes without being affected.

"Ceramic" Weather Resisting Enamels come in white or color and are available in powder or paste form ready for use.

Alkali Resisting, Acid Resisting, Satin Etch Finish, High and Low Fire, Convexing, dry or Paste Squeegee Colors—White and Colored Weather Resisting Enamels—Colored or Crystal Ices—French Fat Oil, Squeegee Oils for Low Fire, High Fire or Overlapping Work—Decorating Supplies and Chemicals.

COLORS, CHEMICALS AND SUPPLIES
FOR GLASS, POTTERY AND ENAMEL

"Ceramic" COLORS
CERAMIC COLOR & CHEMICAL MFG. CO.
NEW BRIGHTON, PA., U.S.A.

CHEMICAL SOCIETY'S GLASS SYMPOSIUM

(*Continued from page* 446)

Industrial developments, such as arc or flame welding, high temperature furnaces and the like, have made use of very dark glasses, transmitting as little as 0.01 per cent of visible radiation. Such glasses must also reduce the transmission of infra-red and ultra-violet to such an extent that these undesired harmful radiations are reduced to less than the amount of visible light transmitted.

Twenty-five years ago a welding glass that transmitted less than 25 per cent of the total energy of a high intensity source, however dark the glass, was a rarity. Now 0.01 per cent total energy transmission would be considered high in the better glasses. These glasses containing as much as 9 per cent iron oxide suitably balanced between ferrous and ferric compounds, reduce both the infra-red and ultra-violet transmission greatly.

Another important optical characteristic of glass is its refractivity or index of refraction which may be defined as its light-bending power, a property obviously important in optical design.

Of course, until the science of optics came into being, the index of refraction of glass was not important or known. Its importance grew with that science and eventually consideration also had to be given to the variation of index of refraction for light of different colors.

Glasses of widely differing indices of refraction and dispersions (variation of index with the color of the light) are of great value to the optical designer.

As to the future, it is difficult to predict just what advances may be made in glass from an optical point of view. New methods of melting, as in porous refractories lined with platinum foil, possibly by electric heating, or by electron bombardment in vacuo, combined with supersonic vibration to prevent segregation and bubbles may help to give us glasses now undreamed of.

Melting, shaping, heat-treating, extracting and sintering, as used in making the new super Pyrex, may allow us to make desirable optical glasses capable of being made in no other way. It may be that glasses will be made by chemical reaction and precipitation at room temperatures, followed by melting, instead of depending upon melting alone, to bring about the chemical reactions between the ingredients of the glass batch. The chemical stabilization of existing glasses, notable those containing lead or barium, suggests that many potentially useful glasses abandoned because of their lack of stability may likewise be modified.

Major advances in the field of silicate glasses may be limited by factors of immiscibility and devitrification but thoroughgoing investigation of other fields should yield rich rewards, and prove of great aid to the optical world.

Physical Tendencies in Current Glass Development. *By G. W. Morey, Geophysical Laboratory.*

The physical trends in the development and uses of glass include the development of new glasses and new uses for glass by modification of physical properties, and the wider use of glass in fields in which its properties have not been fully exploited. The chief method by which changes can be made by physical means is the control of thermal history by subjecting the glass to predetermined heat treatment. The differences obtained are of two kinds: first, those due to the stress resulting from purely mechanical strain; and, second, those resulting from the freezing-in of an equilibrium condition characteristic of some high temperature. The theory of these two effects was discussed and applied to the explanation of the heat treatment given glass in commercial processes. These include not only such new products as the very strong, almost unbreakable "tempered" glass as well as the new glass resulting from a chemical change manifested by enormously increased solubility which makes possible the manufacture of the new high silica Vycor Brand glass. Other new uses illustrating present-day physical trends are glass block, architectural glass, and glass fibers.

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ABSTRACTS OF GLASS DIVISION PAPERS

(*Continued from page* 434)

Mimeographed copies of both the standard and routine methods were distributed. The former are for use in work of the highest accuracy, where time and expense factors are secondary. The tentative methods are offered for consideration in plant control, and for the purpose of giving publicity to newer methods which may well supplant the older methods as they are more widely used and tested.

In both types of methods there are departures from the so-called classical procedures. The most important change is the breaking away from a "continuing" analysis made on a single sample, as contrasted with a single determination on a single sample, or simultaneous determinations on aliquot portions of a master solution of a single sample. Other important recommendations are fusions with restricted amounts of flux, less handling of silica, the expulsion of silicon and boron in the preparation of master solutions for use in certain determinations, and the specification of gravimetric or volumetric 8-hydroxyquinoline methods for R_2O_3, and MgO, of the partition method for B_2O_3, of the triple acetate method for Na_2O, and of the Hicks method for K_2O.

The Standard Methods call for six samples, and provide for determinations of SiO_2, B_2O_3, SO_3, Fe_2O_3, BaO, Al_2O_3 + P_2O_5 TiO_2 + ZrO_2 + FeO_3 + V_2O_5, CaO, MgO, Na_2O, and K_2O. In these methods separate samples are used for the three basic constituents and for iron oxide; the fifth sample is used for Na_2O and K_2O, and the sixth sample for the remaining basic constituents.

The Routine Methods call for five samples and provide for SiO_2, B_2O_3, SO_3, F, "R_2O_3", BaO, CaO, MgO, Na_2O, and K_2O. In these methods the acidic constituents are determined in four separate samples, and the basic constituents on aliquot portions of a solution prepared from the fifth sample.

After this brief description of the methods, a round table discussion was held with Dr. Lundell leading the discussion.

Some Observations on the Chemical Durability of Glass. *By A. K. Lyle & D. E. Sharp, Hartford-Empire Co.*

The relative chemical durabilities of glasses as measured by one accelerated test may be materially changed when some other test is used, particularly when the amount of attack is greatly different in the two tests. However, if series of tests, in which the time-temperature relations have been adjusted so as to result in equal chemical attacks when applied to a single glass, are used for testing other glasses, it will be found that the relative chemical durabilities of the glasses will be the same by any test of the series. This point was demonstrated by data obtained from tests on six commercial bottle glasses in the form of 16 ounce capacity flasks. The following test conditions were found to produce nearly identical results when water was used as the attacking medium:

1 hour at 120°C, 8 hours at 95°C, 24 hours at 85°C and 70 hours at 75°C.

Excluding the point for 1 hour at 120° these data can be represented by a straight-line plot on semi-logarithmic coordinates when the time in hours on the log scale is plotted against the temperature on the equal parts scale. Extrapolation of the line to one year indicates that a temperature of 28° would be required to produce the same amount of chemical attack as that produced in the accelerated tests. The general equation for the time-temperature relation of chemical attack of glasses by water is as follows:

$$\text{Log } t = a\,\theta + b$$

where t is time
θ is temperature
a and b are constants

Data from two other investigations were shown to follow this law. When the glasses were of the same type the constant "a" of the equation remained unchanged while the constant "b" varied only with the base conditions of time and temperature.

The value of this relation lies in its use in establishing the test condition for accelerated testing that will predict the service behavior of glass containers.

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AWARDED KIMBLE GLASS CONTRACT

Contract has been awarded to the H. K. Ferguson Company, Cleveland, by Kimble Glass Company, to design, build, and equip a Batching, Mixing, and Conveying unit to supply the existing glass manufacturing plant at its Vineland, N. J. factory. The building will be 177′ x 60′, one story, structural steel frame, corrugated iron sides and roof, and concrete floors. Included is a 12-bin raw material concrete storage, 24′ wide by 55′ long by 60′ high; also the revamping of the existing coal handling equipment to meet the requirements of the new addition. The plant produces chemical, biological and pharmaceutical apparatus and containers.

CRYOLITE MINES PATROLLED

In a recent dispatch by the Associated Press, it was revealed for the first time that the cryolite mines of Greenland have been under a protective patrol since June 1 by the United States. The patrol is maintained by four Coast Guard vessels, manned by 500 men. These Greenland mines are the world's only commercial source of cryolite, a mineral used not only as a batch constituent of glass, but for extracting aluminum from bauxite ore.

CORNING BANS VISITORS

The Corning Glass Works has been classified by the government as an establishment essential to the national defense program. As a result, Corning officials announced that only persons on business may be admitted to working departments. Other regulations necessary for cooperation with the defense program are expected to follow.

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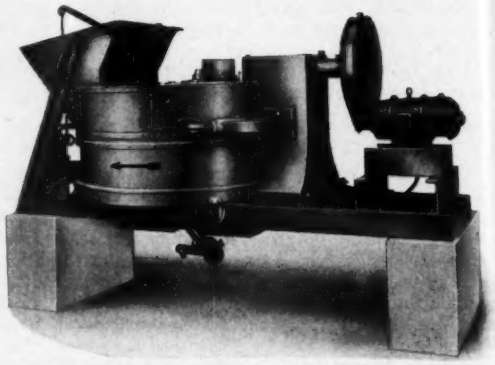

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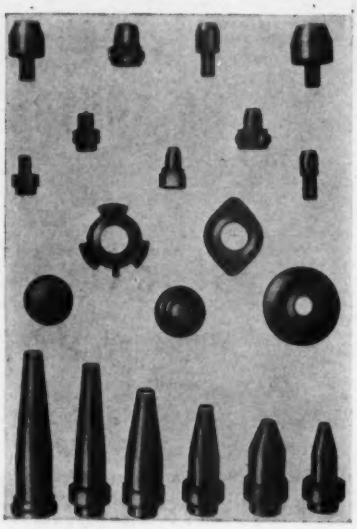

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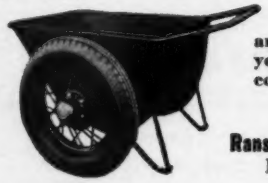

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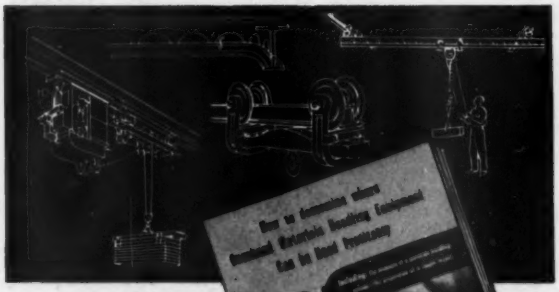

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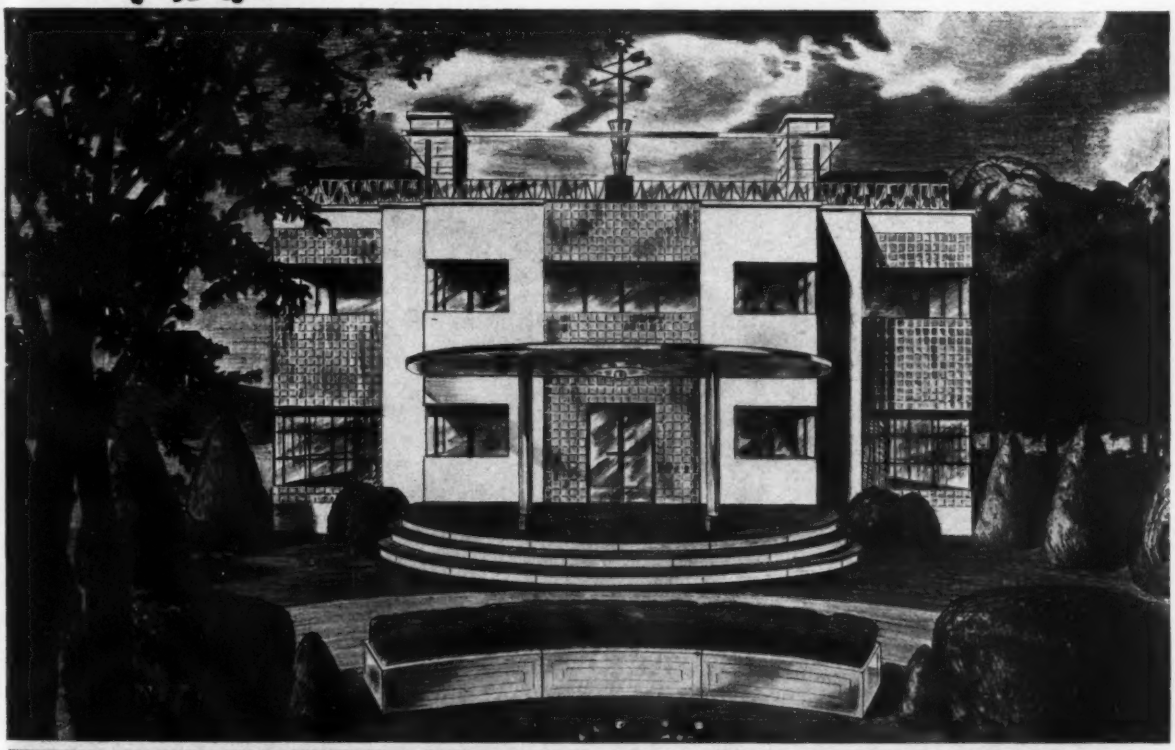

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